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Pre-hospital risk factors affecting mortality and impaired level of consciousness in traumatic brain injury: an update

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ABSTRACT

Traumatic brain injury (TBI) is a major health preventable disease; this study is concerned about prehospital risk factors affecting mortality and impaired consciousness assessed by Glasgow coma scale after follow up for fourteen days. This study was conducted on 100 patients admitted to Emergency department at Alexandria main University Hospital with blunt or penetrating moderate and severe traumatic brain injury and assessed according to sex, age, trauma mechanism, prehospital time, SBP, Respiratory rate, oxygen saturation, GCS, pupil reaction and trauma severity assessed by revised trauma score.

Key words: (Pre-Hospital Risk Factors, Traumatic brain injury)

INTRODUCTION

TBI is the leading cause of death in about two thirds in trauma patients especially in younger population. (Patel HC et al, 2005) (1) Severe TBI has a high mortality rate in the early period and survivors present many major, in-hospital complications. (Schirmer-Mikalsen K et al, 2007) (2) Surviving patients after severe TBI suffer also from a lower life expectancy than the general population.(Baguley IJ et al, 2012) (3). The pathophysiology of severe TBI can be divided into primary and secondary brain injury.(Rosenfeld JV et al, 2012) (4). Primary injury results from the direct, physical brain trauma with tissue distortion, shearing, vascular injury, and cell destruction probably related to rotational acceleration and deceleration inertial forces. Secondary brain injury is related to destructive inflammation and biochemical changes. Secondary injury starts within minutes of primary injury, may last for several days and contributes to the final outcome. (Cernak I et al 2004, Hellal F et al, 2004) (5, 6). Factors associated with secondary brain injury are arterial hypotension, hypoxemia and hypothermia; these adverse events are associated with increased mortality and poor outcome. (McHugh GS et al, 2007) (7)Out-of-hospital emergency medical systems (OHEMS) should ensure the shortest possible delay between the sustainment of the trauma and the patient's admission to a trauma center and decrease the factors associated with secondary brain injury (Hukkelhoven CW et al, 2002) (8).

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MATERIAL AND METHODS

This prospective epidemiological study was conducted on 100 consecutive patients with either blunt or penetrating head trauma admitted to Alexandria Main University Hospital. Our objective was identifying prehospital risk factors associated with traumatic brain injury and their relation to mortality and impaired level of consciousness. We included all patients with these criteria: age from 16 to 60 years old, penetrating or blunt trauma, all patients with GCS <13 on arrival and

all patients with irrelevant past medical history. All the following steps will be done on admission: Complete history taking on admission including (age, sex, mode of trauma, time lapse between trauma and arrival to the hospital and the way of transport), OHEMS interventions: (pre-arrival notification, airway management manoeuvres, administration of IV fluids, control of external bleeding if any and prevention of hypothermia), Clinical examination as regard, ABCDE approach(A=airway, B=breathing, C=circulation, D=disability, E=exposure), Radiological work up: focusing on CT brain, Lab investigations and Outcome parameters will be carried out at 14 day of follow up period to calculate mortality rate and level of consciousness according to GCS.

RESULTS AND DISCUSSION

In this study, Total number of patients was 100 patients. Eighty six of them were male (86%) while fourteen patients were females (14%). Their mean age was 38.04 ± 17.05. Seventy three patients died (73%). Their mean age was 39.55 ± 17.23. Twenty seven patients were alive (27%). Their mean age was 33.96 ± 16.16. According to time before arrival to the hospital we had only 61 cases. Forty four patients who died took a mean of 3.33 ± 1.12 hours before arrival while seventeen patients who survived took a mean of 2.76 ± 1.15 hours.

Table 1 shows distribution of Dead and Alive patients according to systolic blood pressure (SBP), respiratory rate (RR), Oxygen Saturation and temperature.

From the 73 patients who died, thirty five patients (47.9%) were hypotensive (<90), twenty patients (27.4%) were normotensive (90 – 120) and eighteen patients (24.7%) were hypertensive (>120). While from the twenty seven patients who survived, seven patients (25.9%) were hypotensive (<90), eleven patients (40.7%) were normotensive (90 – 120) and nine patients (33.3%) were hypertensive (>120). These differences between two groups (dead and alive) were statistically significant where p=0.048.

From the 73 patients who died, twenty three patients (31.5%) had Tachypnea (more than 20), eight patients (11%) had respiratory rate within normal range (20 -12) and forty two patients (57.5%) had Bradypnea (less than 12). While from the twenty seven patients who survived, eight patients (29.6%) had Tachypnea (more than 20), thirteen patients (48.1%) had respiratory rate within normal range (20 -12) and six patients (22.2%) had Bradypnea (less than 12). The percentage of bradypnic patients among dead cases was statistically significant (p<0.001)

From the 73 patients who died, twenty three patients (31.5%) had oxygen saturation ≥90 and fifty patients (68.5%) had oxygen saturation <90. And also from the twenty seven patients who survived, twenty one patients (77.8%) had oxygen saturation ≥90 and six patients (22.2%) had oxygen saturation <90.The percentage of patients with saturation< 90 was statistically significant among dead cases (p<0.001).

As regard hypothermia there was only two cases that died.

According to mode of trauma, Road traffic accidents (RTA) had the predominance with (64%) of all patients then FFH with (15%) of all cases then gunshot(pellets) with (7%) , alleged assault with (6%) ,falling down with

Table-1. Comparison between Dead and Alive groups according to SBP, RR, Saturation and temperature

	Dead (n =73)		Alive (n = 27)		Total (n = 100)	
	No.	%	No.	%	No.	%
SBP						
Hypotensive (<90)	35	47.9	7	25.9	42	42.0
Not hypotensive	**38**	**52.1**	**20**	**74.1**	**58**	**58.0**
Normotensive (90 – 120)	20	27.4	11	40.7	31	31.0
Hypertensive (>120)	18	24.7	9	33.3	27	27.0
(p)	3.923*(0.048*)					
RR						
Tachypnea (more than 20)	23	31.5	8	29.6	31	31.0
Normal (bet 20 -12)	8	11.0	13	48.1	21	21.0
Bradypnea (less than 12)	42	57.5	6	22.2	48	48.0
(p)	18.123*(<0.001*)					
Saturation						
≥90	23	31.5	21	77.8	44	44.0
<90	50	68.5	6	22.2	56	56.0
(p)	17.126*(<0.001*)					
Temp						
Normal	71	97.3	27	100.0	98	98.0
Hypothermic	2	2.7	0	0.0	2	2.0
(p)	0.755 (1.000)					

(5%) and each of falling heavy object , near drowning and falling down and RTA &near drowning had one (1%) of all cases.

Died cases was 3.94 ± 2.07. While from the 27 patients who survived, eleven patients (40.7%) had low RTS, fifteen patients (55.6%) had moderate RTS and

Table-1. Comparison between Dead and Alive groups according to GCS on admission

	Dead (n = 73)		Alive (n=27)		Total (n=100)	
	No.	%	No.	%	No.	%
GCS on admission						
12 -9 (moderate)	13	17.8	19	70.4	32	32.0
3-8 (severe)	60	82.2	8	29.6	68	68.0
χ^2(p)	25.025*(<0.001*)					

χ^2: Chi square test
*: Statistically significant at p ≤ 0.05

Table 3: Comparison between Dead and Alive groups according to RTS

	Dead (n = 73)		Alive (n = 27)		Total (n = 100)	
	No.	%	No.	%	No.	%
RTS						
Low	1	1.4	11	40.7	12	12.0
Moderate	50	68.5	15	55.6	65	65.0
High	22	30.1	1	3.7	23	23.0
χ^2(p)	31.955*(<0.001*)					
Min. – Max.	0.0 – 6.90		0.0 – 7.84		0.0 – 7.84	
Mean. ± SD	3.94 ± 2.07		6.39 ± 1.81		4.60 ± 2.27	
Median	4.16		6.90		4.74	
t(p)	5.449*(<0.001*)					

χ^2: Chi square test, t: Student t-test
*: Statistically significant at p ≤ 0.05

Table 2 shows distribution of dead and alive patients according to GCS on admission. From the 73 patients who died, thirteen patients (17.8%) had moderate traumatic brain injury (GCS 12-9) on admission and sixty patients (82.2%) had severe traumatic brain injury (GCS3-8)on admission. While from the 27 patients who survived, nineteen patients (70.4%) had moderate traumatic brain injury (GCS 12-9) on admission and eight patients (29.6%) had severe traumatic brain injury (GCS3-8) on admission. The percentage of dead patients who had severe traumatic brain injury (82.2%) was significantly higher than that of alive patients (29.6%) where p<0.001.

According to the pupil reaction. From the 73 patients who died, forty nine patients (67%) had abnormal pupil reaction. While from the 27 patients who survived, fifteen patients (55.6%) had abnormal pupil reaction, however, this difference was statistically insignificant where p=0.285. also there was no statistical significance with the decreased level of consciousness.

Table 3 shows distribution of Dead and Alive patients according to Revised trauma score (RTS). From the 73 patients who died, one patient (1.4%) had low RTS, 50 patients (68.5%) had moderate RTS and 22 patients (30.1%) had high RTS. The mean RTS for one patient (3.7%) had high RTS. The mean RTS for Alive cases was 6.39 ± 1.81. The mean RTS of dead patients 3.94 ± 2.07 was significantly lower than that of alive patients 6.39 ± 1.81 where p<0.001

All the results had no statistical significance difference at the level of consciousness follow up.

Discussion

Traumatic brain injury is a major preventable health problem; the current study was conducted about the prehospital risk factors affecting both mortality and impaired level of consciousness in those patients. There were an association between the mortality rate and these parameters :(prehospital hypotension, hypoxia, bradypnea, GCS on arrival and Revised Trauma Score). But there were no statistical significance between other risk factors (sex, age, hypothermia, prehospital time and abnormal pupil reaction).

In a recent study done by Sophia Tohme, et al at Switzerland on severe traumatic brain injury and assessing nearly the same risk factors affecting mortality and impaired level of consciousness at 14 day of follow up, they found an association between

prehospital hypotension, hypothermia and high mortality and also found an association between hypoxia and impaired level of consciousness. (9) Among the studies that have considered GCS and patients outcome, the findings of the current study are consistent with those of Mizraji, et al. (10) In another study attributed by Gwaram UA, et al , found that RTS could be used as a predictive value in assessing mortality in trauma patients and also found statistical significance with the severity of head injury. (11)

Conclusion

1. Traumatic brain injury is a serious preventable health problem.
2. Road traffic accidents are the most common cause of TBI in our country.
3. High mortality and Disability after moderate or severe TBI.
4. Prehospital hypotension, hypoxia, bradypnea significantly affect mortality.
5. Lack of services introduced by our OHEMS such as increasing the time before arrival to hospital, improper dealing with the cases, lack of documentation and lack of pre-arrival notification.
6. Revised Trauma score can be used to in assessment and prognosis in TBI.

Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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